Japanese Patent Application Laid-Open (KOKAKI) No. 57-142888

Laid-Open Date: September 3, 1982

SPECIFICATION

1. Title of the Invention

Manhole opening method in tanks

2. What Is Claimed:

A manhole opening method in a tank comprising the steps of opening a top cover screwed up to an upper part of the cylindrical body of the manhole provided at an upper part of the tank body and opening into the inside of the tank, and then gas-cutting the closing cover welded to the inside of said cylindrical body, wherein a safe gas is supplied to fill between the said closing cover and a bottom cover screwed to a lower part of said cylindrical body, the top cover being opened before or after that, then the closing cover is removed by gas-cutting, and finally the bottom cover is opened.

3. Detailed Description of the Invention

The technique disclosed herein belongs to a field of the art for removing a welded closing cover of a manhole provided at an upper part of a tank such as a flat-bottomed cylindrical low-temperature tank.

Thus, the present invention pertains to a manhole opening method according to which when opening for inspection a manhole provided for facilitating construction and maintenance works at an upper part of the tank body, first a top cover screwed up to an upper part of the cylindrical body is removed, and then the closing cover sealed by welding to the said cylindrical body is gas cut to remove it. More particularly, the invention relates to a manhole opening method in a tank in which a safe gas, such as an inert gas, is supplied between a bottom cover screwed to the bottom of the said cylindrical body and the said closing cover and let permeate to replace the remaining gas in the tank, then the said top cover is removed almost synchronously with the above operation while the closing cover is safely cut out by gas cutting, and finally the bottom cover is removed.

As is well known, the storage tanks, especially fluid storage tanks have been enlarged in size in recent years, and are subjected to an opening test periodically for the check of fatigue of the body with time due to variation of internal pressure and thermal behavior or non-periodically for the inspection of the tank inside after a big earthquake or other unexpected natural phenomena. .

In order to facilitate such check works, a manhole of the type used for the constructions is utilized. For

example, as shown in FIG. 1, a manhole 3 is provided at the top of the internal tank body 2 of a flat-bottomed cylindrical low-temperature tank 1 for enabling carrying-in of materials or entrance and exit of the workers during construction works, and in conducting the said test, first the stored fluid and then the gas in the tank are discharged out, and thereafter the manhole 3 is opened to allow entrance and exit into or from the tank through the manhole.

In the manhole, after construction thereof, as illustrated in FIG. 2, a top cover 8 is tightly secured to a top flange 5 of the cylindrical body 4 by bolts 6 and nuts 7. However, there is a possibility that the stored gas would leak inevitably in operation and diffuse in the insulating material 9, so that, as shown in the drawings, a tight closing cover 10 is incorporated by welding 11 as a blind cover in the inside of the cylindrical body 4 to provide tight closure and security against gas leak.

When opening the manhole for conducting inspection, therefore, it is required to take away the top cover 8 and then remove the closing cover 10, and usually gas cutting is employed therefor because of ease of operation and other advantageous factors such as high efficiency.

Gas purge from the inside of the tank body 2 is usually conducted after fluid discharge as mentioned above, but there still is a possibility of existence of residual

gas in the tank, and if such residual gas should exist in the tank, there is a risk of explosion triggered by gas arc. Thus, the prior art had the problem that confirmation of non-existence of residual gas was very difficult.

In view of the above-said prior art problems involved in opening the tank manhole for inspection or other purposes, the present invention is envisioned to provide an effective method for opening a tank manhole according to which a bottom cover is secured by bolts and nuts to a lower part of the said cylindrical closing cover, and when opening the manhole, a safe gas such as an inert gas is supplied between the said closing cover and the bottom cover to purge and replace the residual gas in the tank and fill the tank with this safe gas, after which the top cover is removed from the cylindrical body, then the closing cover is opened by gas cutting with no fear of explosion, and finally the said bottom cover is removed.

An embodiment of the present invention which can fulfill the above object is described below with reference to FIGS. 3 to 5. In these drawings, the same reference numerals are used to indicate the same parts as those in the mechanism of FIGS. 1 and 2.

In FIG. 3, the tank in concept here is a flat-bottomed cylindrical low-temperature tank same as shown in FIG. 1. At the top of the inner tank body 2 is secured by welding a

cylindrical body 4 of a manhole 3' in opposition to an outer tank manhole and facing the inside of the inner tank 2, and a top cover 8 is secured sealedly to an upper flange 5 of the cylindrical body 4 by a combination of bolts 6 and nuts 7. Also, a tight closing cover 10 is provided as a sealing blind cover at a middle position of the structure by welding 11 as in the conventional art.

In this embodiment of the invention, there is also provided a bottom cover 13 as a blind cover which is secured sealedly to a lower flange 12 of the said cylindrical body 4 by bolts 6 and nuts 7 from the inside of the cylindrical body 4. Further, a gas discharge pipe 15 and a purging pipe 16 are provided in connection to the space 14 defined by the sealing cover 10 and the bottom cover 13, and these pipes are passed through the outer tank 17 (shown at a lower position than the top cover 8 for the convenience of illustration) and connected to an inert gas source (safe gas source), not shown, through a pipe 20 via valves 18 and 19. They are further connected to a gas recovery tank, not shown, or the gas is released to the atmosphere through a pipe 22 via a valve 21.

Numeral 23 designates a pressure equalizing pipe which is connected into the inner tank 2 via a valve 24 and to the pipe 20 at its position located between the said valves 18 and 19.

In the manhole 3' of the above-described structure, after construction of the tank, the bottom cover 13 is closed tightly, the closing cover 10 is welded tightly to the cylindrical body 4, and finally the top cover 8 is closed, followed by closure of the outer tank manhole. In operation of the tank, the valves 19 and 21 are closed while the valves 18 and 24 are opened to let the gas in the inner tank 2 enter into and fill the space between the closing cover 10 and the bottom cover 13 from the gas discharge pipe 15 through the pipes 23 and 20, thereby equalizing the pressure on both inside and outside of the bottom cover 13 to prevent gas leak due to stress strain of the bottom cover 13.

For carrying out inspection of the inner tank 2 at a desired timing in tank operation, the valve 24 is closed to discharge the fluid while purging the gas in the inner tank 2 through a fluid discharge mechanism and a gas discharge mechanism, not shown, and then the valve 19 is opened to supply an inert gas into the space 14 from the gas discharge pipe 15 through the pipe 20 and valve 18. The valve 21 is also opened to discharge the gas in the space 14 by the purging pipe 16 through the pipe 22, replacing it with the supplied inert gas which now fills the space 14.

In this arrangement, the bottom cover 13 remains unstrained as it has undergone pressure equalization, and no

leak of the inert gas occurs in the inner tank 2.

After the space 14 has been filled with an inert gas in this manner, the valves 18, 19 and 21 are closed to turn the space 14 into an inert gas-filled space. At this point, the outer tank manhole is opened and the bolts 6 and nuts 7 are taken off to remove the top cover 8, exposing the closing cover 10, and the weld 11 between the closing cover 10 and the cylinder 4 is cut out by prescribed gas cutting.

Here, it is possible to employ a method in which the weld 11 is cut out while continuing supply and discharge of the inert gas without closing the valves 18, 19 and 21. In this case, there is no need of designing the bottom cover 13 and the cylindrical body 4 to be a perfectly airtight structure.

Also, in this case, there is no fear of causing explosion even if the arc should reach the space 14 because an inert gas is present in the space..

Finally, the cut closing cover 10 is removed, and the bolts 6 and nuts 7 are driven out to remove the bottom cover 13, thereby opening the manhole 3′ as shown in FIG. 5.

In this state, the necessary materials, instruments, etc., are taken into or out of the tank through the manhole 3′ as indicated by an arrow mark, and on ending the desired inspection or other works, the bottom cover 13 is again fastened in position by the bolts 6 and nuts 7, then the

closing cover 10 is set by welding for closure, and the top cover 8 is mounted in place to restore the original state.

The mode of practice of the present invention is not limited to the above-described embodiment, but the invention can as well be embodied in many other ways, for example: air may be used in place of an inert gas; the top cover may be removed before gas replacement; the pressure equalization means may be omitted; the bottom cover may be designed to be two-staged.

The type of the tanks to which the present invention can be applied is not limited to the flat-bottomed cylindrical low-temperature tanks; the invention can as well be applied to the spherical tanks, gas tanks, petroleum tanks, etc.

According to the present invention, as described above, there is provided a method for opening a manhole provided at the top of a tank body, in which a safe gas such as an inert gas is supplied in the space between a bottom cover and a welded closing cover, the latter being provided between the top and bottom covers of a cylindrical body opening into the inside of a tank, so as to replace the leak gas in the tank and fill the tank inside with the supplied safe gas, so that basically when opening the tank, there can be produced a state where there exists absolutely no explosive gas in the lower part of the said closing cover even after the stored

fluid or gas has been purged.

Therefore, as the bolted top cover is removed almost simultaneously with the leak gas replacement with a safe gas, there is no fear of explosion even if gas cutting of the closing cover is conducted immediately. There is also no risk of the residual gas effusing from the manhole when the closing cover is removed.

Also, the removal work is easy as it is merely required to remove the bolted bottom cover after cutting out the closing cover, and further this bottom cover offers the convenience that it can be utilized for temporary placing or support of the cut closing cover.

4. Brief Description of the Drawings

FIG. 1 is a schematic illustration of a tank.

FIG. 2 is an illustration of a tank manhole based on the prior art.

FIGS. 3 to 5 are the illustrations of an embodiment of the present invention, wherein FIG. 3 is an illustration for gas replacement, FIG. 4 is an illustration for cutting of the closing cover, and FIG. 5 is an illustration for opening the bottom cover.

1: tank

2: inner tank body

3′: manhole

4: cylindrical body

8: top cover

11: weld

10: closing cover

13: bottom cover

FIG.1

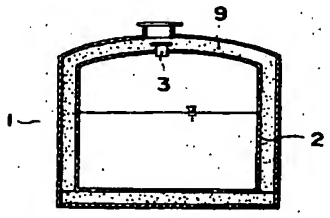


FIG.2

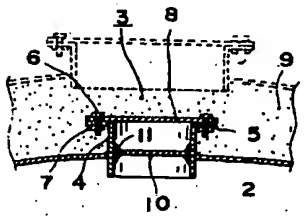


FIG.3

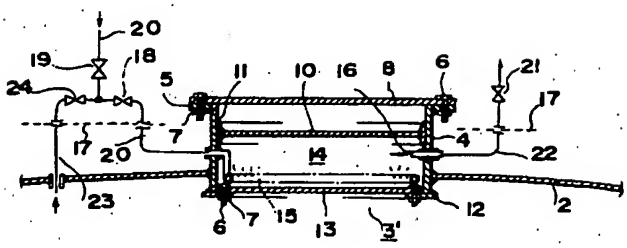


FIG.4

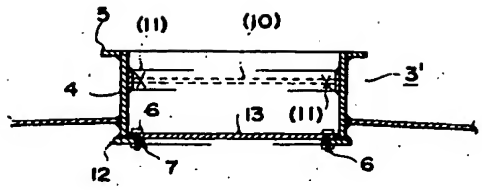
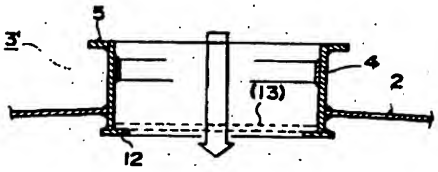


FIG.5



⑲ 日本国特許庁（JP）　　⑪ 特許出願公開

⑫ 公開特許公報（A）　　昭57—142888

⑤1Int. Cl.³　識別記号　庁内整理番号
B 65 D 90/10　6916—3E

㊸公開　昭和57年(1982) 9月3日

発明の数　1
審査請求　未請求

（全 4 頁）

⑤4タンクのマンホール開放方法

㉑特　願　昭56—20106
㉒出　願　昭56(1981) 2月16日

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明　細　書

1. 発明の名称　タンクのマンホール開放方法

2. 特許請求の範囲

タンク躯体上部に設けられ該タンク内に臨ましめたマンホールの筒体上部に螺着した上蓋を開き該筒体内に溶接した密閉蓋をガス切断して開放するマンホール開放方法において、上記密閉蓋と前記筒体下部に螺着した下蓋との間に安全ガスを充満し、その前後にて前記上蓋を開き、該密閉蓋をガス切断して外し、最後に該下蓋を開く様にしたことを特徴とするタンクのマンホール開放方法。

3. 発明の詳細な説明

開示技術は平底円筒低温タンク等のタンク上部に設けたマンホールの溶接密閉蓋の取り除き技術の分野に属する。

而して、この発明は該平底円筒低温タンク等のタンク躯体上部に設けた工事用、メンテナンス用マンホールの点検時開放に際し、まず、その円筒体上部の螺着上蓋を取り外し、次いで、該筒体に溶接シールした密閉蓋をガス切断して取り外す様にしたマンホール開放方法に関するものであり、特に、該筒体の下部に螺着した下蓋と上記密閉蓋との間に不活性ガスの如き安全ガスを送給して貯留ガスパージ置換を介し充満させ、その状態と相前後して前記上蓋を取り除き安全に密閉蓋をガス切断し、最後に下蓋を取り外す様にしたタンクのマンホール開放方法に係るものである。

周知の如く、貯蔵タンク、就中、貯液タンクは近時大型になり、内圧変動、熱挙動による経時的躯体の疲労チエック等のため定期的に、又、大地震後の内部点検等のため非定期的に開放検査する様にされている。

而して、これに対処するに建造に際して用いるマンホールを利用するが、例えば、第１図に示す様に平底円筒低温タンク１の内槽躯体２の頂部にマンホール３が建造時の資材搬入、作業員の出入り用に設けられており、上記検査に際しては貯液排出後ガス排出してマンホール３を開放し出入りを行う様にしている。

ところで、該マンホール３は第２図に示す様に

建造後、その筒体4上部フランジ5にボルト6、ナット7を介して上蓋8を緊着密閉させているが、経時運転中不可避的に貯留ガスがリークし、保冷材9中に放散するおそれがあるため、図示する様に該筒体4内部に盲蓋として密閉蓋10を溶接11して密閉し、確実にガスリークを防止する様にしている。

従つて、上記検査開放に際しては該上蓋8の取り除き後該密閉蓋10を除去する必要があるが、通常取扱いの容易さ、能率等の条件からガス切断が用いられている。

さりながら、前記の如く排液後タンク躯体2内から一応ガスパージを行つているものの、残留ガス存在のおそれがあり、不測にして該残留ガスがタンク内に存在する場合、ガスアークにより爆発の危険がある欠点があり、残留ガス不存在確認が極めて困難である難点があつた。

この発明の目的は上記これまでのタンク上記マンホールの検査時開放に伴う問題点に鑑み、上記円筒の密閉蓋の下位に下蓋を螺着し、マンホール開放に際し該密閉蓋と下蓋との間に不活性ガスの如き安全ガスを供給し既存在ガスを放出置換して充満し、その前後にて上蓋を筒体から取り外し、爆発させることなく該密閉蓋をガス切断して開き、最後に上記下蓋を取り外す様にした優れたタンクのマンホール開放方法を提供せんとするものである。

次に上記目的に沿うこの発明の1実施例を第3図以下の図面に従つて説明すれば以下の通りである。尚、第1，2図と同一態様部分については同一符号を用いて説明するものとする。

第3図に於て、対象タンクは第1図同様平底円筒低温タンクであり、その内槽躯体2の頂部には外槽マンホールに対向してマンホール3′の筒体4が内槽2内に臨ませて溶接固定され、その上部フランジ5にはボルト6、ナット7を介して上蓋8がシール裡に締結固定される様にされており、又、中程設定部位にはシール用盲蓋としての密閉蓋10が在来態様と同じく溶接11を介して溶接されている。

而して、この発明に於ては該筒体4の下端フランジ12にボルト6、ナット7を介して該筒体4内側から同じくシール裡に下蓋13が盲蓋とされて締結される様にされ、又、該密閉蓋10と下蓋13とで形成される空間14に対してガス放出管15、及び、パージ管16が設けられ、それぞれ外槽17（図示の都合上上蓋8より低く示してある。）を通つてバルブ18，19を介装する配管20により図示しない安全ガス源としての不活性ガス源に接続し、バルブ21を介し配管22により図示しない回収タンクに接続、或いは、大気放出等されている。

尚、23は均圧管であり、バルブ24を介し内槽2内と上記バルブ18，19間の配管20に接続させてある。

上記構造のマンホール3′に於て、タンク建造後は下蓋13を締結閉鎖し、密閉蓋10をして筒体4に溶接密閉し、最後に上蓋8を締結閉鎖し、外槽マンホールも密閉し、タンク運転に際してはバルブ19，21を締め、バルブ18，24を開き配管23，20を介しガス放出管15により内槽2内のガスを上記密閉蓋10と下蓋13間の空間14に充満させ、下蓋13内外の圧力を均圧にし、該下蓋13の応力歪によるリーク防止を図る様にしておく。

而して、タンク運転に於て所定タイミングで内槽2の検査を行うにはバルブ24を閉じ図示しない排液機構、排ガス機構を介し内槽2内の貯液を取り出し、貯留ガスをパージし、次いで、バルブ19を開いて配管20、バルブ18を介しガス放出管15により空間14内に不活性ガスを送給すると共にバルブ21を開き、配管22を介しパージ管16により該空間14内のガスを排出し置換により該不活性ガスを充満させる。

この場合上記均圧を経ているので下蓋13は歪んでおらず、不活性ガスの内槽2内リークは生じない。

この様にして不活性ガスが空間14に充満されるとバルブ18，19，21を閉じ、該空間14内を不活性ガス空間とし、そこで、外槽マンホー

ルを開き、続いて第4図に示す様にボルト6、ナット7を外し、上蓋8を取り外し、密閉蓋10を露呈し所定ガス切断により該密閉蓋10と円筒4との溶接11を切断する。

尚、この際、バルブ18，19，21を閉じずに、不活性ガスを供給、排出しつつ溶接11を切断する方法をとることも可能であり、この場合には、下蓋13と筒体4とは気密性を完全に保持する構造とする必要はない。

又、この場合、アークが空間14に及んでも不活性ガスのため爆発のおそれはない。

そして、最後に切断密閉蓋10を外ずし、第5図に示す様にボルト6、ナット7をとり下蓋13を取り外しマンホール3'を開放する。

その後矢印の様に該マンホール3'から資材、装置を出入れし、所定の検査作業を終えれば、再びボルト6、ナット7により下蓋13を締め、密閉蓋10を溶接密閉し、上蓋8を組つけて旧に戻す。

尚、この発明の実施態様は上記実施例に限るものでないことは勿論であり、例えば、不活性ガスに代えて空気置換でも良く、又、ガス置換前に上蓋取り外しをしても良く、均圧手段を省略しても良いし、下蓋を2段にしても良い等種々の態様が採用可能である。

そして、対象タンクは平底円筒低温タンクに限らず、球状タンク、ガスタンク、石油タンク等も可能である。

上記の如くこの発明によれば、タンク躯体頂部に設けたマンホールの開放方法に於て、タンク内に臨ましめた筒体の下蓋と上蓋の間に設けた溶接密閉蓋と該下蓋との間に不活性ガス等の安全ガスでリークタンク内ガスを置換充満させる様にしたことにより基本的にタンク開放に際し、貯液貯ガスをパージした後に於ても該密閉蓋下部に完全に爆発性ガスが存在しない状態を現出することが出来る優れた効果が奏される。

従つて、該安全ガス置換に前後して螺着上蓋を取り外すことにより直ちに該密閉蓋のガス切断を行つても何ら爆発のおそれがない効果があるばかりでなく、残留ガスが密閉蓋取り除きに際しマンホールから流出するというおそれもない効果がある。

又、該密閉蓋切断後に螺着下蓋の取り外しを行えば良いので取り外しが楽である上に該切断密閉蓋の仮置、支えにすることも出来る便利さがある。

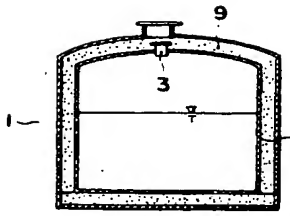
4. 図面の簡単な説明

第1図はタンク概略説明図、第2図は従来技術に基づくタンクマンホール説明図、第3図以下はこの発明の1実施例の説明図であり、第3図はガス置換説明図、第4図は密閉蓋切断説明図、第5図は下蓋開放説明図である。

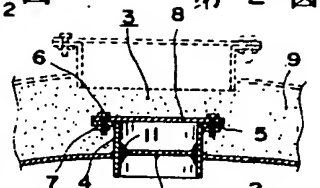
1…タンク、　2…躯体、
3'…マンホール、　4…筒体、
8…上蓋、　11…溶接、
10…密閉蓋、　13…下蓋

出願人　川崎重工業株式会社
代理人　富　田　幸　春

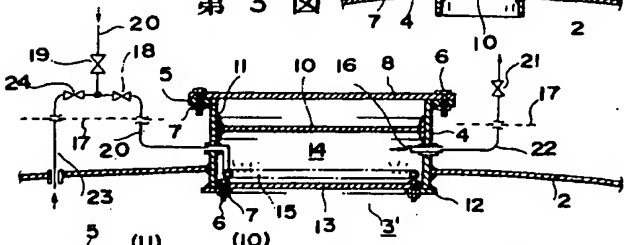
第1図



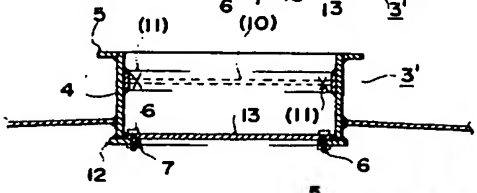
第2図



第3図



第4図



第5図